ANOSIA PLEXIPPUS, L. (*DANAIS ARCHIPPUS*, F.): A STUDY IN GEOGRAPHICAL DISTRIBUTION.

BY JAMES J. WALKER, R.N., F.E.S.

At the present time, when Entomologists are discussing the probability of the beautiful butterfly first described by Linné under the name of *Papilio* (*Danais*) *Plexippus* (but which is perhaps better known by the Fabrician name of *D. Archippus*) becoming a permanent resident in our islands, on the strength of the dozen specimens or more captured last autumn in the South of England, it may be interesting to give a brief account of the insect and its transformations, and then to consider its present geographical distribution. It is in the latter respect that the butterfly is most remarkable, for within the last thirty or forty years it has spread from its original home in the American continent over more than half the warmer regions of the globe, and now bids fair to soon become as world-wide in its distribution as our more familiar "Painted Lady," *Pyrameis cardui*.

My acquaintance with *Anosia Plexippus* (or rather with the well-marked *Erippus*, Cram., by many Entomologists raised to the rank of a distinct species) began at Monte Video, where, in December, 1880, I found the insect in small numbers. A few months later, at Callao, I had abundant opportunities of observing it in all its stages, it being one of the commonest butterflies of the locality. Here one could make sure, on almost any day in the year, of seeing the imago on the wing, though it was most abundant in January and February, and scarcest in July. The handsome larva, too, was always to be found wherever its food-plant grew, and as it was singularly easy and interesting to rear, I was seldom without several feeding in my cabin on board the "Kingfisher." During our cruise among the South Sea Islands in 1883, the first visitor from the shore of any island we touched at was usually the bold flying *Danais*, and in some of them, considering the recent introduction of the butterfly, its abundance was very remarkable.

As most Entomologists are doubtless familiar with the perfect insect, it need not here be described. According to my own experience, it seems to prefer waste weedy places and gardens near towns and villages, its flight being strong, though rather heavy, and it is not very difficult to catch. As if aware that it is a distasteful morsel to all insect-eating creatures, it seeks no concealment whatever, and I have often seen two or three, at sunset, roosting together on the summit of some tall weed in the middle of a field, and visible a hundred or more yards off.

The egg is laid singly, on the under-side of the leaves of various species of *Asclepias*, more particularly the *A. curassavica*, a very handsome, tall, upright-growing plant, with willow-like leaves and corymbs of showy orange and scarlet flowers, every part being full of an acrid, fœtid, and powerfully emetic milky juice. It is about one-twentieth of an inch long by one-thirtieth in diameter, in shape nearly cylindrical for half its length, then tapering to a somewhat obtuse point, and with a flat base ; its form may perhaps best be compared to one of the projectiles for modern rifled guns, known as "Palliser shot." Its surface is sculptured with about 22 strongly carinate longitudinal ribs, between which is a rather larger number of more delicate transverse ridges, and its colour is a pale-greenish yellow.

In four or five days to a week (varying with the time of year) the little larva emerges, and at once falls to work on the flowers and buds of its food-plant, proceeding to the leaves as it grows larger. In three weeks it is full-fed, and is then a very handsome and conspicuous creature, feeding quite exposed, and often stripping the *Asclepias* to the bare stalks.

The full-grown larva is about two inches in length, rather stout, and nearly cylindrical in form, the head and second segment, however, being considerably smaller than the succeeding ones. On the dorsal surface of the 3rd segment is a pair of slender, fleshy, slightly mobile black filaments, nearly half-an-inch long, and a similar but somewhat smaller pair on the 12th segment. The head is yellow, with two concentric ⊓-shaped black markings on the face: the mouth-parts, legs, and claspers shining black. The body is regularly annulated with black, opaque white, and bright gamboge-yellow, arranged as follows :—The front and hind-margins of segments 3 to 12 yellow, with a narrow transverse black band reaching the spiracular region : the middle part of the segment white, with a broad, clearly defined black band extending completely round the body, and including the black spiracles and the claspers, above the first four pairs of which is a rather large white spot, slightly tinged with yellow. The second and thirteenth segments have no white markings.

The pupa is suspended by the tail among the leaves of its food-plant, or to neighbouring objects, and is one of the most beautiful I have seen. Its shape is very short and "dumpy" with no prominent angles, and abruptly truncate at either end, the abdominal end especially being nearly hemispherical. The colour is a bright translucent emerald-green, with a narrow transverse black ridge on the hinder edge of the third abdominal segment, bordered behind by a narrow, brilliantly gilded line : on the thoracic segments and wing-cases are several minute tubercles of the brightest golden hue.

This stage lasts from fourteen to twenty days, the colours of the imago, just before disclosure, being very plainly visible through the thin translucent integument. It will thus be seen that, in Peru, the insect passes through all its stages in little more than six weeks, and there is a succession of probably seven or eight broods throughout the year. Beyond the tropics, the annual number of broods is of course less, though, according to Mr. Scudder, there are three or four in the warmer parts of the United States : but at its northern limit, it is probably only single-brooded.

Both larva and imago emit a faint and peculiar odour, which becomes strong and disagreeable when several larvæ are shut up in a close box. Like all the *Danaidæ*, the insect, in all its stages appears to be distasteful to every living creature.

Although small insect-eating birds are wonderfully numerous at Callao, the larvæ are untouched by them, and I have never bred an Ichneumon-fly or any other parasite from the numerous larvæ I have reared. In the United States, however, Mr. Riley informs us that the larva is attacked by a Dipterous fly, *Masicera* (*Tachina*) *archippivora*, Riley. The tenacity of life in the imago is very remarkable, as is also its longevity, as according to Mr. S. H. Scudder, it has been kept alive for fifteen months.

The original home of *Anosia Plexippus* is the American continent, where it enjoys a very wide range, extending from the Hudson's Bay territory and Canada to the Amazon region and Bolivia, or (if we regard *Erippus*, Cram., as a geographical race merely) to the estuary of the Rio de la Plata. Mr. J. Jenner Weir has received it from Moose Fort (lat. 50. 20 N.) where snow lies on the ground for eight months of the year, and I heard of it, though I did not see it, at Esquimalt, Vancouver Island, in nearly the same latitude. It thus ranges over nearly 90° of latitude, and extends farther North than any other of the *Danaidæ* (*D. Tytia* in Japan, and *D. Chrysippus* in South-eastern Europe, barely, if at all, reaching the 40th parallel). Nearly everywhere throughout this vast region, it appears to be common, and in many places, especially in the United States, it is one of the most abundant butterflies. Here it is often observed in prodigious swarms, and according to Mr. Riley (to whose lucid and admirable account of the insect, in the Third Annual Report on the Insects of Missouri, I am very much indebted) the air is sometimes filled with the butterflies to a height of 300 to 400 feet. These vast swarms usually appear in the autumn, and some of them at least, Mr. Riley states, migrate southwards to warmer regions at the approach of winter.

Of late years this range, great as it is, has extended in a wonderfully steady and rapid manner across the whole breadth of the Pacific Ocean, and far into the Malay Archipelago. *Anosia Plexippus*, unobserved by the early voyagers to the Sandwich Islands, is now abundant and firmly established there. In the Marquesas Islands, where it is now the commonest butterfly, I was informed by a Roman Catholic missionary, who had resided forty years on the island of O. Hiva-Oa (Dominica), that he distinctly remembered seeing the first specimens about the year 1860: certainly so conspicuous an addition to the very limited insect-fauna of these islands could not have been long overlooked. In the Society Islands (Tahiti and Eimeo) and the Cook and Hervey groups (Mangaia, Rarotonga, Aitutáki, and Atiú) I saw both the butterfly and its food-plant *Asclepias curassavica* in plenty, and the latter, indeed, is a pest to cultivation in some of the

islands. The insect has even reached the remote little island of Oparo or Rāp-á, far away to the southward; but I could not meet with it at Pitcairn Island, nor did any of the inhabitants, to whom I showed specimens, recognise it as existing there.

Mr. G. F. Mathew, R.N. (to whom I am greatly indebted for some most interesting notes on the butterfly as observed by him during his recent cruise in H.M.S. "Espiègle," as well as a full list of localities, given further on), informs me that *Anosia Plexippus* is found throughout the Samoan, Friendly, and Fiji Islands, and is especially abundant in the latter group, which he regards as perhaps its head-quarters (at the present time) in the Western Pacific. It appears also to have reached the North Island of New Zealand, as well as Norfolk Island. In New Caledonia, where it has been long established, it became very abundant some years ago, but is now comparatively scarce, owing, as suggested by Mr. E. L. Layard to Mr. Mathew, to the destruction of nearly all the food-plant by the larvæ. We first hear of its occurrence in Australia in 1870, when Mr. Miskin (Ent. Mo. Mag., vol. viii, p. 17) records its appearance in Queensland: it now seems to have spread throughout all the warmer parts of this great island, and even to Hobart Town (Tasmania) in lat. 42° S. In the New Hebrides, Solomon Islands, New Guinea, and other islands in that part of the Pacific, it appears to be now firmly established and not rare; but it was not seen by Mr. Mathew at the Gilbert, Ellice, and Marshall Islands, nor at the Carolines, though he noticed the *Asclepias* at the latter group, and Mr. Scudder (Psyche, vol. i, p. 81) records the occurrence of young larvæ at Ponapé Island (Carolines) on some "milk-weeds" (*Asclepias*) which had been accidentally introduced. Dr. Semper has recorded the butterfly from Celebes, and Mr. W. F. Kirby informs me that it has been found in Java.

Starting from the eastern coast of America, we find *Anosia Plexippus* throughout the West Indies in company with some curious local forms of the genus; and it has long been established in the Bermudas, 650 miles from the coast of the United States. Two examples, now in the collection of Messrs. Salvin and Godman, were taken in 1864 in the islands of Fayal and Flores respectively, but I cannot ascertain that any have since been found in the Azores, nor did I see the insect when there in October, 1880. It does not seem to have reached Madeira, though *Asclepias curassavica* has found its way to that island.

The first record of the occurrence of *Anosia Plexippus* in Britain is in 1876 (Ent. Mo. Mag., vol. xiii, p. 107), a specimen having been taken by Mr. J. T. D. Llewelyn at Neath in South Wales, on Septem-

ber 6th of that year. This is now in the British collection at the Natural History Museum, South Kensington, and is a very fine example of the ordinary North American type. Another was taken at Hayward's Heath, Sussex, in the autumn of the same year (Entomologist, vol. ix, p. 267). In September, 1877, a specimen was captured by M. Grassal in La Vendée (Petites Nouvelles Entomologiques, II, pp. 253, 254), the only record I can find of its occurrence on the European continent. A specimen is recorded by Mr. J. Jenner Weir (Entom. vol. xix, p. 12), as having been taken near Snodland, Kent, on September 21st, 1881; but the number seen and caught last year far exceeds all that have been previously noted. A round dozen, at least, have been recorded from our southern counties, Cornwall contributing quite half the number, though Devon, Dorset, and the Isle of Wight have also been favoured with the visits of the imposing stranger (Ent. Mo. Mag. vol. xxii, pp. 134, 161, 211; Entomologist, vol. xviii, p. 305).

The question naturally arises: What has caused this truly wonderful extension of the range of *Anosia Plexippus?* We may, I think, dismiss the idea that the insect and its chief food-plants (noxious and poisonous weeds) may have been voluntarily transported to new lands. The seeds, however, of *Asclepias curassavica* are eminently fitted for wide dispersal, being very minute, and enveloped in a great quantity of light cottony down, and it is quite possible that they may have, in the first instance, been carried unobserved to the Sandwich Islands through the medium of commerce. Thus the first great gap of 2350 miles in extent (measured from the nearest point of the American continent) may have been bridged over by the plant. As for the butterfly, its great hardiness and almost complete exemption from the attacks of enemies, joined with its well-known migratory propensities and habit of assembling in great swarms, render its chances of wide dispersal and ready adaptation to a new home especially favourable. It is wonderful to what great distances butterflies and moths are blown out to sea, and in what good condition they remain, all things considered. Mr. Mathew informs me that he has often seen *Anosia Plexippus* "flying at a great height above the ship, sometimes more than 200 miles from the nearest land. During a cruise between New Caledonia and the Solomon Islands, they were to be seen every day, often in numbers. This looked as if a steady migration was taking place, and the S.E. trade wind, which was blowing strongly at the time, was greatly in favour of the butterflies accomplishing their journey in safety." I once saw *Danais Chrysippus* (a much smaller and less powerful insect than *Plexippus*,) flying about the ship when she was

700 miles from the nearest land (the African coast), still strong on the wing and apparently in good order. Mr. J. M. Jones records the arrival of a vast swarm of the small and feeble *Terias Lisa* at Bermuda, which had evidently crossed more than 650 miles of stormy ocean, from the American coast; and a swarm of *Deiopeia pulchella* (another weak flyer) has been recorded in mid-Atlantic (Ent. Mo. Mag., vol. xxii, p. 12), 960 miles from the Cape de Verde Islands, the nearest land from which the moths could have come, and where I have found the species in plenty.

It is, therefore, not difficult to imagine one of the great migrating swarms of *Anosia Plexippus* being blown out to sea from the Californian or Mexican coast, and travelling with the N.E. trade wind; the greater number by far perishing *en route*, but a few stragglers of the host reaching the Sandwich Islands. This may have occurred many times before the introduction of a suitable food-plant, in which case the butterfly necessarily failed to establish itself; but once given the *Asclepias* it would soon be quite at home. Thence it would have no such tremendous expanses of ocean to traverse in order to reach new lands; the scattered islands (Fanning, Malden, Starbuck, Christmas Islands, and others), between the Sandwich group and those in the South Pacific, although small and mostly barren, might serve as stepping-stones in its progress. The distances between these islands, though great enough, are nothing like the first great step from America to the Sandwich Islands, and not more, I should imagine, than the light and downy seeds of the *Asclepias* could be carried by the agency of winds, &c., alone.

As bearing on this origin of the Pacific specimens of *Anosia Plexippus*, it is significant that they all agree with the North American type: the larger pale spots in the black apical portion of the fore-wing being tawny, not white as in those from the Peruvian coast of South America.

The same remarks may apply to its dispersal across the Atlantic; but owing to the much more stormy character of this ocean, and the less steady winds, the chances of the butterfly crossing a given extent of ocean in safety are less favourable. Still many American birds, some scarcely, if at all, as strong on the wing as *Anosia Plexippus*, find their way to our shores from time to time. We must also take into account the chances of the insect resting by the way on some of the numerous vessels constantly crossing the Atlantic, which, as Mr. Wallace suggests (Geog. Dist. of Animals, vol. i, p. 17), may materially aid the smaller and weaker birds in their occasional passage across

this ocean. We may, therefore, not wonder that circumstances may combine to carry this hardy and by no means delicate insect from the New to the Old World.

With regard to the probability of *Anosia Plexippus* becoming a permanent resident in our islands, there is, I think, nothing in our climate to prevent its continuance here except, perhaps, the dampness of our summer. We have, however, no plant of the natural order *Asclepiadaceæ* native to our flora, so the larva would have to find a substitute food. According to Mr. Riley, however, the larva is sometimes found on the Dogbane (*Apocynum*), and in the South of England we have two plants of the same natural order (*Apocynaceæ*), the Periwinkles, *Vinca major* and *minor* growing plentifully wild, or at all events naturalized in many places. The Oleander, another shrub of the same Order, is grown in the South of England with only slight protection during the winter, and I believe that one or two species of *Asclepias* are occasionally grown in gardens. If, therefore, as Dr. Jordan suggests (p. 211), the newly arrived "colonists" be not too eagerly caught up, but allowed fair play and a chance to perpetuate their race, it may be that in future years *Anosia Plexippus* may figure in our lists as a (naturalized) "Britisher," and perhaps in part make up for the great loss our insect fauna sustained when the "Large Copper" was improved off the face of the earth.

In the South of Europe, besides the advantage of a warmer and drier climate, a probable food-plant exists in the *Asclepias vincetoxicum*, which is common in the Mediterranean countries, and ranges through Central Europe as far north as Denmark. Hence there is even a greater chance of the insect, if it reaches these countries, establishing itself there than in Britain.

This paper may conclude with a list of localities whence specimens of *Anosia Plexippus* have been obtained, which will give a fair idea of its present distribution.

The National collection possesses specimens from South Wales, New York, Texas, Duenãs (Guatemala), Jamaica, St. Domingo, St. Thomas (West Indies), Venezuela, Brazil, Honolulu, Upolu (Samoan Is.), Tonga-tabu, Solomon Islands, Norfolk Island, and Cape York (North Australia). The six specimens representing the species in the Hewitson collection have no localities attached.

In the magnificent collection of Messrs. Salvin and Godman are examples from E. United States, Colorado, Mexico, Guatemala, Nicaragua, Costa Rica, Veragua, Panamá, New Granada, Ecuador, Eastern Peru, Upper Amazons, Haiti, St. Thomas, Jamaica, Dominica,

Samoa, Lifu (Loyalty Is.), Norfolk Island, New Zealand, New South Wales, New Caledonia, Waigiou, New Guinea, Fayal and Flores (Azores); also (race *Erippus*, Cram.) from N. Brazil, Lower Amazon, Pernambuco, S.E. Brazil, and the Argentine Republic.

Mr. G. F. Mathew has furnished me with the following localities in the Western Pacific, where the insect was observed or heard of by him: Sydney, not common; Parramatta, Newcastle (New South Wales), sparingly; Botany Bay, more frequent; Brisbane and Cooktown (Queensland), common; Tasmania, reported to have occurred at Hobart Town; New Zealand, reported from the North Island; Fiji Islands, in great abundance at all the localities visited, but perhaps most plentiful at Suva; Rotumah Island, common; New Hebrides, common at all the islands, and generally abundant; Samoa, not very common; New Britain and Duke of York Islands, noticed; New Guinea, common at Port Moresby, Dinner Island, Kerepuna, &c.; Solomon Islands, common at Ugi; Louisiade Islands, Friendly Islands, very common, especially at Tonga-tabu; New Caledonia, tolerably common though less so than formerly; also at Honolulu (Sandwich Islands), in thousands in 1873.

I have met with the butterfly at Monte Video (race *Erippus* Cram.), Callao and Lima, abundant; Chosica, Peru, abundant; Guayaquil, Panamá, Acapulco (Mexico), Vancouver Island, reported; Fatou-hiva, Taou-ate, O-Hiva-Oa, and Nuka Hiva (Marquesas Islands), generally common; Tahiti and Eimeo (Society Islands), common, especially in Tahiti; Mangaia, Rarotonga, abundant; Aitutáke, common, and Atiú; Oparo or Rãp-á Island, one or two specimens seen.

H.M.S. "Cherub," Portland:
11*th February*, 1886.

DESCRIPTION OF A NEW GENUS, AND SOME NEW SPECIES OF *CORYLOPHIDÆ*.

BY REV. A. MATTHEWS, M.A.

Among the New Zealand *Corylophidæ* in the collection of Dr. Sharp, I found the two very remarkable species described below. In superficial appearance these insects much resemble the *Trichopterygidæ*, but really belong to the *Sericoderina* of the *Corylophidæ*. From *Sericoderus* itself they are distinguished by their peculiarly formed 11-jointed antennæ, and other anatomical differences, and thus constitute a very distinct genus, which I propose to call *Anisomeristes*, from the unequal proportions of the articulations of the antennæ, and of which the following are the chief diagnostic characters:—